

Present knowledge of the arachnofauna of Slovakia and its utilization for biota quality evaluation and monitoring

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Present knowledge of the arachnofauna of Slovakia and its utilization for biota quality evaluation and monitoring. - Although the Slovak Republic is a small country, it has a very rich spider fauna. Based on all the literature data and unpublished data of present arachnologists, 920 spider species have been found in Slovakia, belonging to 37 families (state at 15th of July 1995). From this number of species, 61 species are recorded in the older literature, while the original documentary material is not available, and many of these species records are dubious. Not less than 379 species are included into a Red list of spider of Slovakia. The majority of the data on the spiders of Slovakia have been brought together. At the present, the database on spiders contains more than 50-thousand records from 1793 localities on Slovak territory. These data are utilized as the analytical entries for the "Local and Regional Territorial System of Ecological Stability" projects, for ecological evaluations of larger landscape areas, mainly from the point of nature conservation. Biological evaluations are based on species diversity, on occurrence of threatened species and the richness of threatened species recorded from each square and from each geomorphological unit.

Key-words: Spiders - database - distribution - biota evaluation - Slovakia.

INTRODUCTION

The territory of Slovakia belongs to the Western Carpathians and is characteristic by its high diversity and unique nature of the biotopes in Europe. This has a great influence on the diversity of organisms including spiders. The diversity of flora and fauna is disturbed on many places by human activities such as intensive industrial, agricultural production, etc.

Spiders have been used as bioindicators of the environmental status, particularly of human influence on the landscape (BOHAC & RUZICKA 1988; BUCAR 1983, 1991; RUZICKA 1987; RUZICKA & BOHAC 1994). During the last two hundred years

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there is a great number of data recorded on the spiders of Slovakia, which are used for evaluation and monitoring of the country. One of the possibilities of this kind of evaluation is the evaluation of the spiders occurrence in squares based on square mapping or in geomorphologic units.

HISTORY OF SPIDER RECORDING

In order to establish a basis for the evaluation of the territory of Slovakia, it is necessary first of all briefly describe the history of spider recording and the present state of knowledge. The beginnings of arachnology in Slovakia are connected to the development of arachnology in the Austro-Hungarian Empire. One of the first works done on this field is the work of SCOPOLI (1772) which deals with the research of spiders and insects "Observationes Zoologicae". The author summarized the research done in the area of Banska Stiavnica. The first clear arachnological work done in Slovakia was the work of BÖCKH "The spiders of Bratislava area", published in 1857. His next two articles was published in 1862 and also deal with the arachnofauna of Bratislava and the surrounding area.

There are other observations done in the 19th century, however they deal with the fauna of spiders only marginally (by Romy, Bartholomaeides). One of the works of great importance done in the 19th century in the area of arachnology is the work of HERMAN (1876, 1878, 1879) consisting of 3 volumes. In the last volume he dealt with the expansion of spiders on the territory of Hungary. He mentioned 90 species from 15 locations of today's Slovakia. The most important and the most complex source of data on spiders from the territory of Slovakia is the complex work of CHYZER & KULCZYNSKI published in 1891, 1894, 1897 and 1899: " Araneae Hungariae". From 807 species of the spiders of Hungary in this work, 489 are mentioned from the area of today's Slovakia. At the end of the 19th and the beginning of the 20th century, other smaller works appeared discussing the territory of today's Slovakia, which have only regional concerns (by Chyzer, Kulczynski, Malesevics, Mocsary, Nowicki, Ortway, Petriesko, Wajgiel).

After the first world war many Czech arachnologists were taking part in the research of the arachnofauna of Slovakia such as Baum, Bartos, Kratochvil and mainly Miller who lived and worked in Slovakia in 1929 - 1938. Within the years 1934 - 1939, eight published faunistic articles of Miller dealing with the arachnofauna of Slovakia appeared. Most of his research was done in the area of Turiec where the author lived. Individual and sporadic data from the first half of the 20th century were sporadically found in the works of Hungarian zoologists (Csiki, Dudich, Entz, Kolosvary and Szilady).

A milestone in the development of arachnology was the work of MILLER (1971) " Klic zvireny ". Here he summarized all his research and experiences also from the territory of Slovakia. A more systematic research of the arachnofauna of Slovakia started in the 1970-ies with appearing of Slovak arachnologists as Svaton, Zitnanska, Vachold, Jedlickova, later Thomka, Gajdos, Pavlik, Pekar, Krumpalova and others. Also Czech arachnologists took some part in the research of Slovakia as

Miller, Buchar, Ruzicka, Majkus, Antus, Kasal and others. The research mainly concentrated on the National Reservations (N.R.), Protected Landscape Areas (P.L.A.) and National Parks (N.P.), also on not disturbed or very little disturbed territories as the N.R. Bab, N.R. Jursky Sur, N.R. Sulovske skaly, P.L.A. Ponitrie, P.L.A. Velka Fatra, P.L.A. Vychodne Karpaty, P.L.A. Slovensky kras, P.L.A. Muranska planina, P.L.A. Male Karpaty, P.L.A. Biele Karpaty, N.P. Vysoke Tatry, N.P. Mala Fatra, N.P. Nizke Tatry, Vychodoslovenska nizina, Zemplinske vrchy, etc. Step by step the research went on to the areas very much influenced by human activity as Liptovska Mara, Zemplinska Sirava, the Turcianska kotlina, the agrocenoses of Malanta, the Podunajska nizina and the areas surrounding the Danube and Morava Rivers, etc.

METHODS

For the overall evaluation of the territory of Slovakia from the viewpoint of spiders distribution we used the database containing 50788 records recorded from 1793 localities in Slovakia (state at 15th of July 1995). The overview of all localities is shown on Fig. 1. In the database there are data from published literature and the data from Czech and Slovak arachnologists. We evaluated the territory of Slovakia according to squares used for middle European square mapping by ZELENY (1972) and according to geomorphologic units by MAZUR & LUKNIS (1980). The grid of square mapping is based on geographic coordinates, with the squares 6 by 10

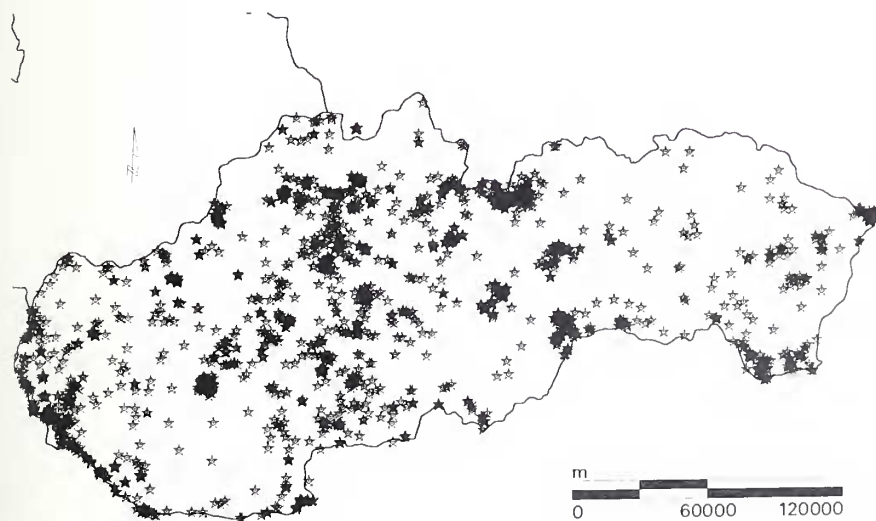


FIG. 1

Localization of spider records from Slovak territory.

geographic minutes, the approximate area is 11 by 12 km. The area of Slovakia is situated on 431 squares (301 are completely inside and 130 are partially in the territory of the country). For the evaluation of the territory of Slovakia based upon the recent knowledge the following criteria were used:

1. number of species occurring in square (Fig. 2) and in geomorphological unit (Fig. 5),
2. number of threatened species in square (Fig. 3) and in geomorphological unit (Fig. 6),
3. evaluation of the diversity of threatened species compared to the total number of found species in square (Fig. 4), based on a modified index of species richness by MARGALEF (1958):

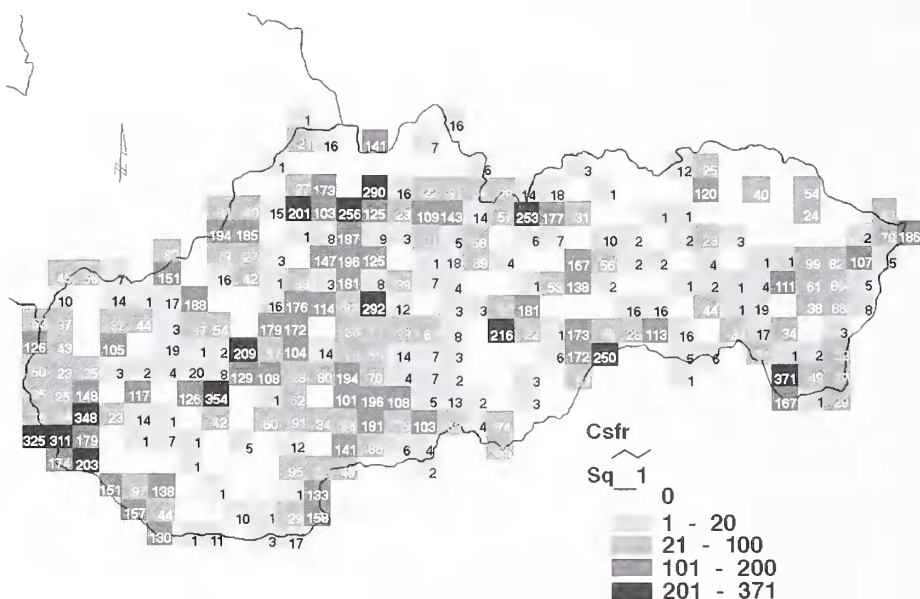


FIG. 2

Number of species recorded from each square.

$$P = 100 * (n / \sqrt{N+1})$$

n is the number of threatened species in square,

N is the total number of species in square.

Based on these criteria, the squares and geomorphological units were put to 4 categories. The resulting map outputs were overlaid with the borderlines of the Protected Landscape Areas by KRAMARIK (1992) (Fig. 7). The calculation of the occurrence of threatened spider species was based upon the Red list of spiders of Slovakia (GAJDOS & SVATON 1995), in which there are 396 spiders included in different categories of threatenment. Doubtful and dubious species were not included to the Red list, and were not used for sites evaluation.

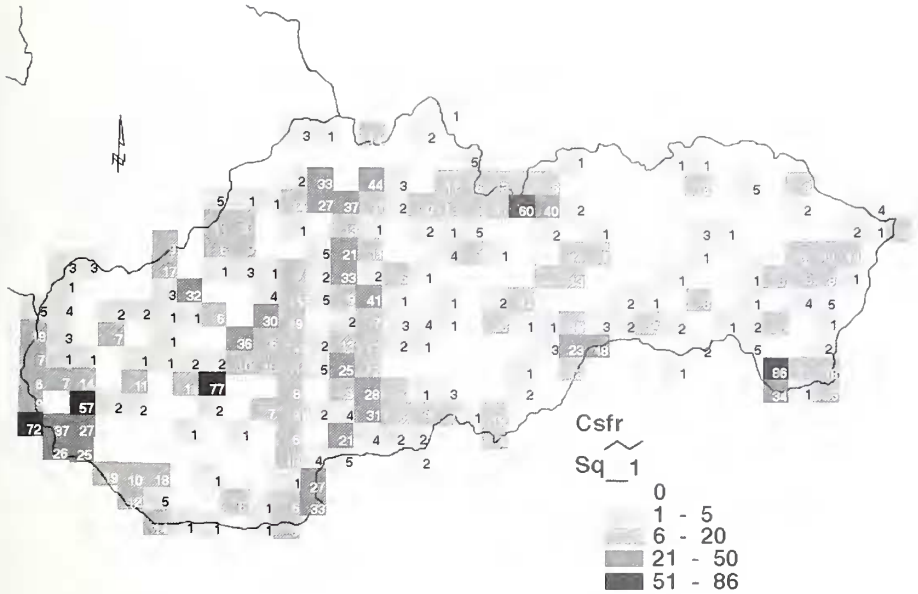


FIG. 3

Number of threatened species recorded from each square.

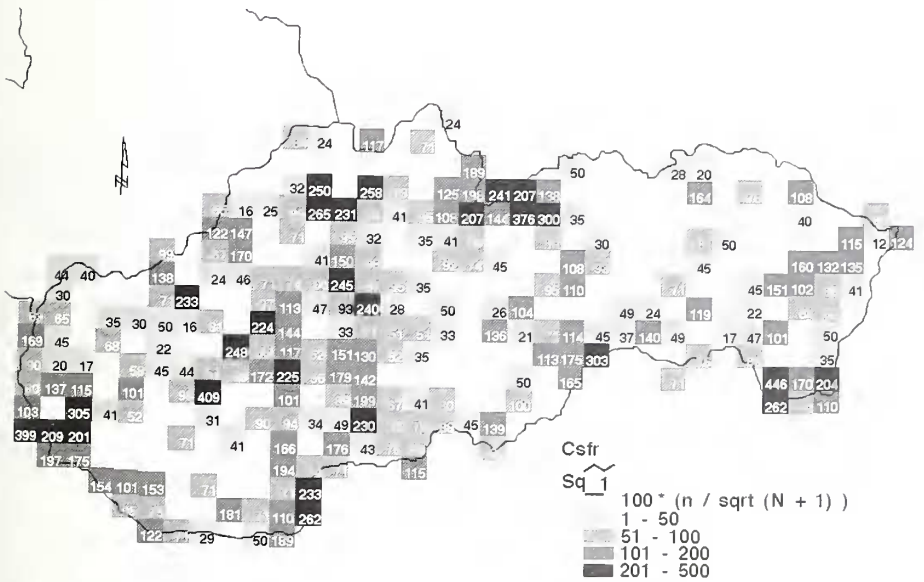


FIG. 4

Diversity of threatened species compared to the total number of found species.

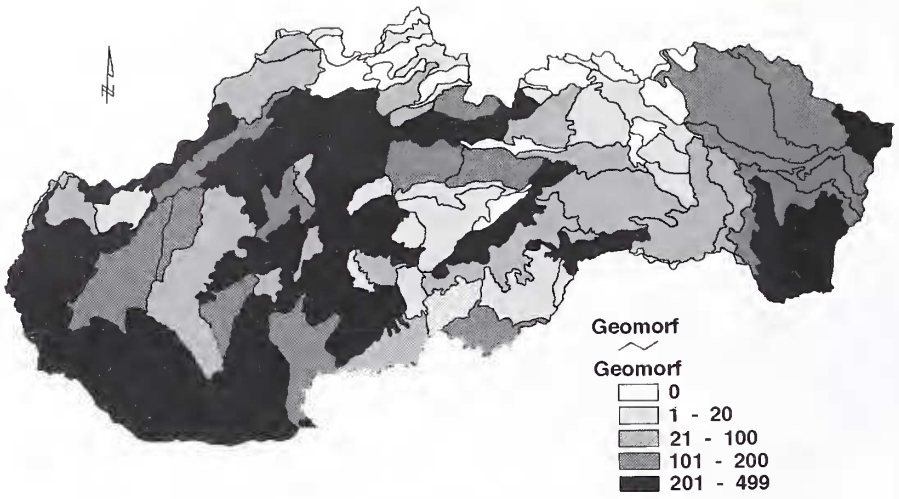


FIG. 5
Number of species recorded from geomorphological unit

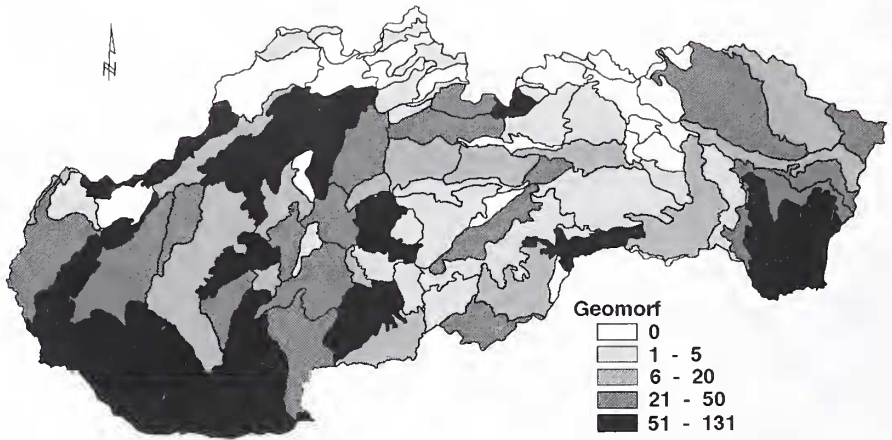


FIG. 6
Number of threatened species recorded from geomorphological unit.

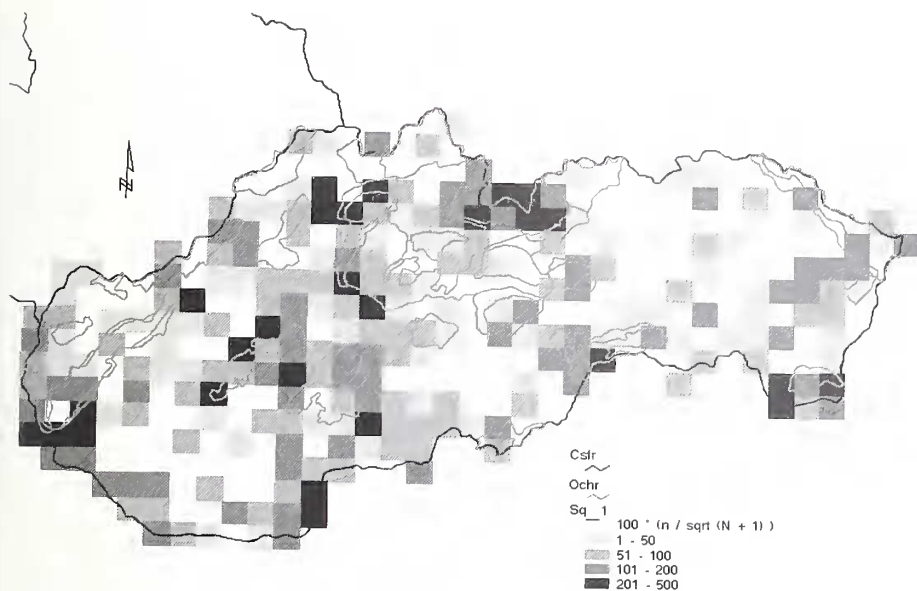


FIG. 7

Diversity of threatened species (from Fig. 4) and boundaries of Protected Landscape Areas.

RESULTS

Altogether, 920 spider species were found in Slovakia, belonging to 37 families. From this number of species, 61 species were recorded in the older literature with the unavailable original documentary material, many of these species records are dubious (state at 15th of July 1995).

From the total number of squares (431) we have up until now data on spiders from 280 squares (65.0%) (Fig. 2). The most abundant number of data are from the squares of the Zemplinske vrchy Mts. from east Slovakia (371 species) and from Zobor part of Tribec Mts. (354 species). Threatened species were found in 234 squares (54.3%). The greatest diversity of threatened species was found at the Zemplinske vrchy Mts. (86 species), at Zobor part of the Tribec Mts. (77 species), at the southern parts of the Male Karpaty Mts. (72 species), in the High Tatras (60 species).

Most of the squares, based on the number of species found and threatened species found, belong to the I. and II. category of evaluation with a lower number of species and threatened species (Tab. 1, 2).

From the total number of 93 geomorphological units, spiders were collected from 77 geomorphological units (82.8%) until now (Fig. 5). Threatened species were found in 72 geomorphological units (77.4%) (Fig. 6). The highest number of species

TABLE 1
The proportion of squares in each category of evaluation.

Category of squares	I	II	III	IV	Total
by the number of species found in square	1-20	20-100	101-200	200+	
Total number of squares investigated in Slovakia	119	93	54	14	280
by the number of threatened species found in square	1-5	6-20	21-50	50+	
Total number of squares with occurrence of threatened species	117	88	24	5	234

TABLE 2
The proportion of geomorphological unit in each category of evaluation

Category of geomorphological units	I	II	III	IV	Total
by the number of species found in unit	1-20	20-100	101-200	200+	
Total number of units investigated in Slovakia	21	18	14	24	77
by the number of threatened species found in unit	1-5	6-20	21-50	50+	
Total number of units with occurrence of threatened species	25	13	18	16	72

was found on the Danube plain (Podunajska nizina) (499 species). This is most of all due to the geographical location in a xerotherm area of Slovakia. Majority of the geomorphological units, which are put to IV. category with the occurrence of more than 200 species, and the occurrence of more than 50 threatened species are parts of Protected Landscape Areas (Fig. 5, 6, 7). The presented results are greatly influenced by the intensity of collecting, the number of collections and the number of localities in a given square. They also represent the present state of knowledge. The map of the diversity of threatened species to the total number of found species gives certain generalization of the results (Fig. 4)

The biologically most valuable areas, from the viewpoint of spiders occurrence, are the southern part of the Male Karpaty Mts., the borderline of the Danube plain and Male Karpaty Mts., the Tribec Mts., Burda Mts., the alluvium of the

Morava River, the surroundings of town Zilina, the High Tatras, Slovensky kras Mts., Zemplinske vrchy Mts., Biele Karpaty Mts., Latorica River.

These results were used as analytical entries for the selection of European most important sites, also as a part of the "ECONET", "CORINE biotopes" projects. The data are utilized as analytical entries for the "Local and Regional Territorial System of Ecological Stability" projects. The elaboration of these projects for each area results from the law.

DISCUSSION

The distribution of spiders and the use of their faunistic data are the part of the works of BUCAR (1991) in the Czech Republic. He used similar criteria for evaluation as we used in our work, that is: the number of found species and the occurrence of selected 72 rare species per square. Most of the squares with greatest diversity of species have been part of Protected Landscape Areas. That corresponds with similar results in our work from Slovakia.

The evaluation of the knowledge and distribution of the fauna of British spiders were published by MERRET (1979). He evaluated the number of found species from each county by 1978. By comparing the counties with our geomorphological units, we came to a similar conclusion that the most valuable and most researched areas showed the occurrence of more than 400 species per evaluated area. We conclude that the data on occurrence of spiders and threatened spiders are very useful entries for landscape evaluation and monitoring.

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